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A Smart System for Garbage and Waste Management using IoT

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Abstract: *This project aims at developing a solution to the problem of overflowing trash cans. Many a time, we see garbage bins that haven't been cleared for a long time or garbage spilling out of the bin. The fetid smell of garbage permeates around, creating a very unhygienic surrounding. To eliminate this problem, we have developed a smart dustbin. The bin uses a proximity sensor to detect the wastage level. When it crosses a certain threshold value, the lid which is controlled by a servo meter automatically closes the bin. A message is then sent to the concerned authority to clear the bin using a GSM module.*

I. INTRODUCTION

Internet of things (IoT) makes the recent world easy and connected together. It tries to establish advanced connectivity among the devices or systems to make the automation in almost all the areas. Recent researches shows that by 2020 nearly 20 billion devices will be IoT monitored. The field of IoT is so vast because of its extensive use in the field of embedded system, Industries and Health Care, management of Infrastructure and Energy, Automation of home appliances and many more.

To make the cities greener, safer and more efficient, IoT can play an important role. Waste collection management by providing intelligence to waste bins uses the IoT prototype with sensors.

Swachh Bharath Abhiyan is the campaign run by the Indian government at the National level to cover the unclean and unhygienic cities to make them clean by promoting sanitation programs, cleaning streets and changing facilities for the betterment of the country. In recent years, due to increasing population growth there is no proper management of waste, which creates the unhygienic condition of wastes such as overflowing bins. This not only harms the environment and the surrounding mankind but also may cause deadliest diseases. For Eg: From a primary survey done in Guwahati, it was found that garbage accumulation causes 41% of the air pollution. Bad waste management also leads to air pollution and soil contamination. As an initiative to Swachh Bharath Abhiyan, we have proposed the idea of 'Smart bins', which is an automatic waste management system and tackles the problem of overflowing bins. It is based on the Concept of IoT which includes a sensor namely proximity sensor that indicates the level of the Bin. Arduino is the interface between sensors and GSM. Sensor based smart bin is used to identify the status of waste bin whether it is full or empty and accordingly schedule the collection of waste and save the cost and time. Through this system the information can be collected from anywhere by the concerned person. In real time the status of all bins can be collected and sent to the concerned authority through GSM module to the registered number and they can send the vehicle to collect garbage and dispose off the bin when the bin is full. The automatic opening and closing of bin adds an extra feature to our system. To favour the present system we have also designed an app that shows the nearby dustbins in the city. The waste across the whole city can be monitored and tracked through a single system efficiently. This system can be implemented in various public places like bus stops, railway stations etc.

II. LITERATURE SURVEY

Garbage collection has become one of the main aspects of a clean and healthier city. As a part of it, many waste management methods have been proposed and implemented in different cities. IoT is the latest method used to solve the problems related to waste management.

- 1) In this system, dustbins were placed in various locations within a campus, installed with low cost embedded device. Every system had its own unique ID. This proposed system could track the level of the bin and transmit the data, along with its unique ID, upon reaching the threshold limit.
- 2) This system uses Wi-Fi Module to update the real time data (Status) of the bin. The system is composed of Arduino based system having IR wireless connection with a central system which updates the status of the bin on a webpage using a Wi-Fi Module.
- 3) This system uses GSM Module to communicate with the server which holds all the information about the filled and unfilled bins. Users are provided with an Android App, which gives the information about unfilled bins. Authorized person is informed about the filled bins.

- 4) This prototype has automatic open dustbin which opens the lid of the bin when a person is detected. When the bin is full, the lid doesn't open even upon detection of a person. Every bin is provided with unique ID. To avoid unpleasant smell coming out of waste bin, harm-less chemical sprinkler is used which will sprinkle the chemical as soon as the smell sensors detect the decaying smell.
- 5) The proposed system uses Ultrasonic sensor to check the level of the bin and Pressure sensing resistor. HTML web page is used to show various levels of every bin located in different places. GSM is used to transmit an alert to the terminal of the particular bin. RFID is used for the authentication and automating the closing and opening of the bin.

III. IMPLEMENTATION

The bin is fully automated with the help of some sensors and also with the help of some mechanical devices which assist in automating the bin. The sensors include the UV sensors which are nothing but acting like the proximity sensors. These also assisted with the Arduino which helps in making decisions. It is also containing a proximity sensor in the front to make the bin open only when it is needed to be open so that the foul smell which arises will not spread in the nearby surroundings.

To go in more detail about the implementation here is how each module works.

A. UV sensor HC-SR04

The HC-SR04 is a device which emits an ultrasound or ultrasound waves of frequency 40000Hz which travels through the air and if there is any object or any obstruction in the pathway can be calculated by considering the travel time and also with the speed of sound. Has set of four pins V_{cc} , Ground, Echo and Trigger pin. our project the HC-SR04 sensor is placed at two different places. One is under the lid of the bin and the other is in outside the bin in front of it. Under the lid is to sense the level of the waste amount present in the bin and the outside one is kept so that the bin opens when only person wants to dump the waste inside the bin.

B. Arduino Uno R3

The Arduino Uno R3 acts as a microcontroller in this project of ours by making decisions on the input sent by various different sensor and instructing the others to do so. The board is kept in the middle with various sensors attached to it.

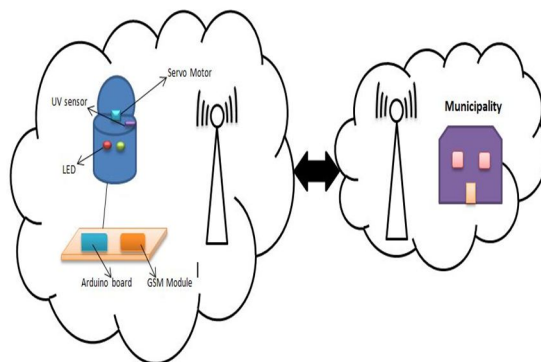
C. Servo Motor

The servo motor which is used in this project is a plastic one which can bear weight up to 9 grams. This is used in our project to make the lid open by itself without human intervention.

D. GSM Module

The GSM module used in our project helps in the communication part of our project. It is used to inform or alert the authorities concerned for cleaning the bin when it is full.

E. Connection



F. Working

The bin initially closed and when a person moves his hand in front of the proximity sensor kept outside it will open responding to the input stimulus. Then the bin will be open for 15 seconds and the person can dump the garbage in this duration. Later after 15



seconds it will close and still if the person wants to dump the garbage he can again do the hand motion. Once full the municipal authorities who are in charge of cleaning the bin will be provided a button for forceful opening and cleaning the garbage of the bin. This will be sealed in a box of which the key will be with the authorities. The authorities will be alerted of the bin full by the GSM module which will send the message when the bin is full. This is the overall working of the project.

IV. CONCLUSION

It is possible to achieve an efficient system which can monitor the bin using sensors and IoT. This approach provides a smart solution for the existing problem, avoiding human intervention, reducing human time and effort and reducing the time taken for the collection process, which results in healthy and clean environment. This project is aimed at making the waste management system a better one compared to the present situation in the day to day world.

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